

ASTM A 53 / A 53M-99b

This specification covers seamless and welded black and hot-dipped galvanized steel pipe in NPS 1/8 to 26 inclusive with nominal wall thickness as given in tables (see the standard)

Pipe may be furnished in the following types and grades :

Type F : Furnace-butt welded (FBW) – Grade A

Type E : Electric-resistance welded (ERW) – Grades A and B

Type S : Seamless – Grades A and B

CHEMICAL REQUIREMENTS MAXI IN %

Types	Grades	C	Mn	S	P	Cr (a)	Cu (a)	Mo (a)	Ni (a)	V (a)
S	A	0.25	0.95	0.045	0.05	0.40	0.40	0.15	0.40	0.08
	B	0.30	1.20	0.045	0.05	0.40	0.40	0.15	0.40	0.08
E	A	0.25	0.95	0.045	0.05	0.40	0.40	0.15	0.40	0.08
	B	0.30	1.20	0.045	0.05	0.40	0.40	0.15	0.40	0.08
F	A	0.30	1.20	0.045	0.05	0.40	0.40	0.15	0.40	0.08

(a) These five elements combined shall not exceed 1 %

TENSILE REQUIREMENTS

Types	Grades	Manufacture	Minimum tensile strength		Minimum yield strength		Minimum elongation
			ksi	MPa	ksi	MPa	in 2", per cent
F	A	Open hearth or electric furnace or basic oxygen	48.0	330	30.0	205	$e = 625.000 A^{0.2} / U^{0.9}$ (See ASTM standard)
E & S	A		48.0	330	30.0	205	
	B		60.0	415	35.0	240	

TOLERANCES

Outside diameter (pipe body)	NPS 1 1/2 (1.900" OD) and under	± 1/64"	(0.40 mm)
	NPS 2 (2.375" OD) and over	± 1 %	
On thickness		– 12.5 %	
On weight		± 10 %	

HYDROSTATIC TEST PRESSURE : see standard detailed specification.

DIMENSIONS : see pages 40 and following

ASTM A 106-99

Seamless carbon steel pipe for high temperature service

CHEMICAL REQUIREMENTS IN %

Grades	C	Mn	S	P	Si	Cr	Cu	Mo	Ni	V
	maxi (a)		maxi	maxi	mini	maxi (b)	maxi (b)	maxi (b)	maxi (b)	maxi (b)
A	0.25	0.27 to 0.93	0.035	0.035	0.10	0.40	0.40	0.15	0.40	0.08
B	0.30	0.29 to 1.06	0.035	0.035	0.10	0.40	0.40	0.15	0.40	0.08
C	0.35	0.29 to 1.06	0.035	0.035	0.10	0.40	0.40	0.15	0.40	0.08

(a) For each reduction of 0.01 % below the specified carbon maximum, an increase of 0.06 % manganese above the specified maximum will be permitted, up to a maximum of 1.35 %

(b) These five elements combined shall not exceed 1 %.

TENSILE REQUIREMENTS

Grades	Minimum tensile strength		Minimum yield strength		Minimum elongation(1)	
	ksi	MPa	ksi	MPa	Longitudinal	Transverse
					in 2", per cent	
A	48.0	330	30.0	205	35	25.0
B	60.0	415	35.0	240	30	16.5
C	70.0	485	40.0	275	30	16.5

(1) Basic minimum elongation transverse strip tests, and for all small sizes tested in full section. For longitudinal strip tests the minimum elongation in 2" shall be: $e = 625.000 A^{0.2}/U^{0.9}$ (see ASTM).

TOLERANCES : Outside diameter : as follows

Nominal pipe size NPS	Outside diameter mm	Variations in outside diameter			
		over		under	
		mm	inches	mm	inches
1/8 to 1 1/2	10.3 to 48.3	0.40	1/64 (0.015)	0.40	1/64 (0.015)
2 to 4	60.3 to 114.3	0.79	1/32 (0.031)	0.79	1/32 (0.031)
5 to 8	141.3 to 219.1	1.59	1/16 (0.062)	0.79	1/32 (0.031)
10 to 18	273.0 to 457.2	2.38	3/32 (0.093)	0.79	1/32 (0.031)
20 to 26	508.0 to 660.0	3.18	1/8 (0.125)	0.79	1/32 (0.031)
28 to 34	711.0 to 864.0	3.97	5/32 (0.156)	0.79	1/32 (0.031)
36 to 48	914.0 to 1219.0	4.76	3/16 (0.187)	0.79	1/32 (0.031)

Note : For pipes NPS 10" (273 mm) and over, possibility to obtain **if specially required** :
outside diameter $\pm 1\%$ or inside diameter $\pm 1\%$

On thickness		- 12.5 %
On weight	Per unit length	+ 10 % - 3.5 %
Hydrostatic test pressure (see ASTM A 530 / A 530 M-99)	Given by the formula $P = \frac{2 S T}{D}$ where P : Test pressure in PSI T : Wall thickness in inches S : Pipe wall stress in PSI D : Outside diameter in inches	
Lengths	If definite lengths are not required, pipe may be ordered in single random lengths of 16 to 22 ft (4.8 to 6.7 m) with 5 % 12 to 16 ft (3.7 to 4.8 m), or in double random lengths with a minimum average of 35 ft (10.7 m) with 5 % 16 to 22 ft (4.8 m to 6.7 m).	

DIMENSIONS : see pages 40 and following

ASTM A 179 / A 179 M-90a (reapproved 1996)

Seamless cold drawn low carbon steel heat-exchanger and condenser tubes.
 1/8" (3.2 mm) to 3" (76.2 mm) included, in outside diameter.

CHEMICAL REQUIREMENTS

Carbon %	Manganese %	Phosphorus maximum %	Sulfur maximum %
0.06 to 0.18	0.27 to 0.63	0.035	0.035

ROCKWELL HARDNESS : not exceeding 72 HRB

TOLERANCES : (see ASTM A 450 / A 450 M-96a)

Outside diameter	< 1" (25.4 mm)	± 0.004"	± 0.10 mm
	1" (25.4 mm) ≤ diameter ≤ 1" 1/2 (38.1 mm)	± 0.006"	± 0.15 mm
	1" 1/2 (38.1 mm) < diameter < 2" (50.8 mm)	± 0.008"	± 0.20 mm
	2" (50.8 mm) ≤ diameter < 2" 1/2 (63.5 mm)	± 0.010"	± 0.25 mm
	2" 1/2 (63.5 mm) ≤ diameter < 3" (76.2 mm)	± 0.012"	± 0.30 mm
	3" (76.2 mm)	± 0.015"	± 0.38 mm
On thickness	For diameter ≤ 1" 1/2 (38.1 mm)	+ 20 % - 0	
	For diameter > 1" 1/2 (38.1 mm)	+ 22 % - 0	
On lengths	For diameter < 2" (50.8 mm)	+ 1/8" - 0	+ 3 mm - 0
	For diameter ≥ 2" (50.8 mm)	+ 3/16" - 0	+ 5 mm - 0
On weight	For diameter ≤ 1" 1/2 (38.1 mm)	+ 12 % - 0	
	For diameter > 1" 1/2 (38.1 mm)	+ 13 % - 0	

HYDROSTATIC TEST PRESSURE : (see ASTM A 450 / A 450 M-96a)

Given by the formula $P = \frac{32000 T}{D}$

T : Specified wall thickness in mm

D : Specified outside diameter in mm

P : Hydrostatic test pressure in PSI

ASTM A 209 / A 209 M-98

SCOPE :

This specification covers several grades of minimum wall thickness, seamless, carbon-molybdenum alloy steel, boiler and superheater tubes.

SIZE RANGE :

Outside diameter : 1/2 to 5 in. (12.7 to 127 mm) .

Minimum wall thickness : 0.035 to 0.500 in. (0.9 to 12.7 mm).

MANUFACTURE :

The steel shall be killed.

The tubes shall be made by the seamless process and shall be either hot finished or cold-finished as specified.

All tubes shall be heat treated.

CHEMICAL REQUIREMENTS :

Grade	Designation UNS	Carbon	Manganese	Phosphorus	Sulfur	Silicon	Molybdenum
		%	%	maxi %	maxi %	%	%
T1	–	0.10 / 0.20	0.30 / 0.80	0.025	0.025	0.10 / 0.50	0.44 / 0.65
T1a	–	0.15 / 0.25	0.30 / 0.80	0.025	0.025	0.10 / 0.50	0.44 / 0.65
T1b	–	0.14 maxi	0.30 / 0.80	0.025	0.025	0.10 / 0.50	0.44 / 0.65

TENSILE REQUIREMENTS :

Grade	Tensile strength mini		Yield strength mini		Elongation mini in 2 in. or 50 mm	Hardness maxi	
	ksi	MPa	ksi	MPa	%	Brinell	Rockwell
T1	55	380	30	205	30	146 HB	80 HRB
T1a	60	415	32	220	30	153 HB	81 HRB
T1b	53	365	28	195	30	137 HB	77 HRB

GENERAL REQUIREMENTS :

To specification ASTM A 450 / A 450 M-96a.

ASTM A 213 / A 213 M - 99a

(Austenitic and stainless steel see page 173)

SCOPE :

This specification covers minimum wall-thickness, seamless ferritic and austenitic steel, boiler and superheater tubes.

SIZE RANGE :

Diameter : 1/8 in. (3.2 mm) in inside diameter to 5 in. (127 mm) in outside diameter
 Minimum wall thickness : 0.015 to 0.500 in. (0.4 to 12.7 mm)

MANUFACTURE :

Tubes shall be made by the seamless process and shall be either hot finished or cold finished, as specified.
 All tubes shall be heat-treated.

CHEMICAL REQUIREMENTS

Nickel Nickel %	Chrome Chromium %	Molybdène Molybdenum %	Vanadium Vanadium %	Niobium Columbium %	Autres / Others %	Nuances Grades
	0.50 / 0.81	0.44 / 0.65				T2
	4.00 / 6.00	0.45 / 0.65				T5
	4.00 / 6.00	0.45 / 0.65				T5b
	4.00 / 6.00	0.45 / 0.65			4 x % C ≤ Ti ≤ 0.70 %	T5c
	8.00 / 10.00	0.90 / 1.10				T9
	1.00 / 1.50	0.44 / 0.65				T11
	0.80 / 1.25	0.44 / 0.65				T12
	0.80 / 1.25		0.15 maxi			T17
	2.65 / 3.35	0.80 / 1.06				T21
	1.90 / 2.60	0.87 / 1.13				T22
	1.90 / 2.60	0.05 / 0.30	0.20 / 0.30	0.02 / 0.08	W: 1.45/1.75 B: 0.0005/0.006 N: 0.03 maxi Al 0.03 maxi	T23
0.40 maxi	8.00 / 9.50	0.85 / 1.05	0.18 / 0.25	0.06 / 0.10	N: 0.03/0.07 Al 0.04 maxi	T91
0.40 maxi	8.50 / 9.50	0.30 / 0.60	0.15 / 0.25	0.04 / 0.09	W: 1.5/2.00 B: 0.001/0.006 N: 0.03/0.07 Al: 0.04 maxi	T92
0.50 maxi	10.00 / 12.50	0.25 / 0.60	0.15 / 0.30	0.04 / 0.10	W: 1.5/2.5 Cu: 0.3/1.7 B: 0.0005/0.005 N: 0.04/0.10 Al: 0.04 maxi	T122
	17.5 / 19.5	1.75 / 2.50			N: 0.035 maxi Ni + Cu: 1 maxi	18 Cr - 2 Mo

TENSILE REQUIREMENTS

Grades	Tensile strength mini		Yield strength mini		Elongation mini (1) in 2 in. or 50 mm	Brinell hardness
	ksi	MPa	ksi	MPa	%	maxi
T2 - T5 - T5c T11 - T17 - T21 - T22	60	415	30	205	30	163
T5b - T9	60	415	30	205	30	179
T12	60	415	32	220	30	163
T23	74	510	58	400	20	220
T91	85	585	60	415	20	250
T92	90	620	64	440	20	250
T122	90	620	58	400	20	250
18 Cr - 2 Mo	60	415	40	275	20	217

(1) Basic minimum elongation for walls 5/16 in. (7.9 mm) and over in thickness, longitudinal strip tests, and for all small sizes in full section.

GENERAL REQUIREMENTS

To specification ASTM A 450 / A 450 M-96a.

ASTM A 333 / A 333 M - 99

Seamless and welded steel pipes for low temperature service

CHEMICAL REQUIREMENTS

Cuivre Copper	Aluminium Aluminium	Vanadium Vanadium	Niobium Columbium	Molybdène Molybdenum	Cobalt Cobalt	Nuances Grades
%	%	%	%	%	%	
						1
						3
0.40 / 0.75	0.04 / 0.30					4
						6
						7
						8
0.75 / 1.25						9
0.15 maxi	0.06 maxi	0.12 maxi	0.05 maxi	0.05 maxi	–	10
–	–	–	–	0.50 maxi	0.50 maxi	11

(A) For each reduction of 0.01 % carbon below 0.30 %, an increase of 0.05 % manganese above 1.06 % would be permitted to a maximum of 1.35 % manganese.

TENSILE REQUIREMENTS

Grades	Minimum tensile strength		Minimum yield strength		Minimum elongation (1)	
	ksi	MPa	ksi	MPa	Longitudinal	Transverse
					in 2" per cent	
1	55.0	380	30.0	205	35	25
3	65.0	450	35.0	240	30	20
4	60.0	415	35.0	240	30	16.5
6	60.0	415	35.0	240	30	16.5
7	65.0	450	35.0	240	30	22
8	100.0	690	75.0	515	22	–
9	63.0	435	46.0	315	28	–
10	80.0	550	65.0	450	22	–
11	65.0	450	35.0	240	18 (2)	–

(1) Minimum elongation for walls 8 mm (5/16") and over in thickness, strip tests, and for all small sizes tested in full section.

(2) Elongation of grade 11 is for all walls.

IMPACT TESTS

Grades	Impact test temperature	
	° F	° C
1	– 50	– 45
3	– 150	– 100
4	– 150	– 100
6	– 50	– 45
7	– 100	– 75
8	– 320	– 195
9	– 100	– 75
10	– 75	– 60

The impact test is not required for grade 11

ASTM A 333 / A 333 M - 99

IMPACT TESTS FOR GRADES 1, 3, 4, 6, 7, 9 and 10

(«V» notch) minimum results.

Size of specimen	Minimum notched bar impact value				Resilience in DaJ / cm ² = $\frac{\text{Mini impact value in DaJ}}{\text{Area in square cm}}$	
	Minimum average value of each set of three specimens		Minimum value of one specimen only of a set		Minimum average value of each set of three specimens (1)	Minimum value of one specimen only of a set (1)
mm	ft.lbf	J	ft.lbf	J	DaJ/cm ²	DaJ/cm ²
10 x 10	13	18	10	14	2.25	1.75
10 x 7.5	10	14	8	11	2.33	1.83
10 x 6.67	9	12	7	9	2.25	1.69
10 x 5	7	9	5	7	2.25	1.75
10 x 3.33	5	7	3	4	2.63	1.50
10 x 2.5	4	5	3	4	2.50	2.00

(1) These values are not prescribed in specification ASTM A 333

IMPACT TESTS FOR GRADE 8

by lateral expansion (see ASTM A 333 / A 333 M-99 - § 8.2)

TOLERANCES : (conform to ASTM A 530 / A 530 M-99)

Outside diameter : as follows

Nominal pipe size NPS	Outside diameter	Variations in outside diameter			
		over		under	
		mm	inches	mm	inches
1/8 to 1 1/2	10.3 to 48.3	0.4	1/64 (0.015)	0.8	1/32 (0.031)
2 to 4	60.3 to 114.3	0.8	1/32 (0.031)	0.8	1/32 (0.031)
5 to 8	141.3 to 219.0	1.6	1/16 (0.062)	0.8	1/32 (0.031)
10 to 18	273.1 to 457.0	2.4	3/32 (0.093)	0.8	1/32 (0.031)
20 to 26	508.0 to 660.0	3.2	1/8 (0.125)	0.8	1/32 (0.031)
28 to 34	711.0 to 864.0	4.0	5/32 (0.156)	0.8	1/32 (0.031)
36 to 48	914.0 to 1219.0	4.8	3/16 (0.187)	0.8	1/32 (0.031)
On thickness					- 12.5 %
On weight per unit length of seamless pipe	NPS 12 and under				+ 10 % - 3.5 %
	Over NPS 12				+ 10 % - 5.0 %

HYDROSTATIC TEST : (see ASTM A 530 / A 530 M-99)

Given by the formula $P = \frac{2 S T}{D}$

DIMENSIONS : see pages 40 and following

ASTM A 335 / A 335 M - 99

Seamless ferritic alloy steel pipes for high temperature service

CHEMICAL REQUIREMENTS

Grade	UNS Designation	Carbon %	Manganese %	Phosphorus maxi %	Sulfur maxi %	Silicon %	Chromium %	Molybdenum %	Others %
P1	K11522	0.10/0.20	0.30/0.80	0.025	0.025	0.10/0.50	–	0.44/0.65	–
P2	K11547	0.10/0.20	0.30/0.61	0.025	0.025	0.10/0.30	0.50/0.81	0.44/0.65	–
P5	K41545	0.15 maxi	0.30/0.60	0.025	0.025	0.50 maxi	4.00/6.00	0.45/0.65	–
P5b	K51545	0.15 maxi	0.30/0.60	0.025	0.025	1.00/2.00	4.00/6.00	0.45/0.65	–
P5c	K41245	0.12 maxi	0.30/0.60	0.025	0.025	0.50 maxi	4.00/6.00	0.45/0.65	A
P9	S50400	0.15 maxi	0.30/0.60	0.025	0.025	0.25/1.00	8.00/10.00	0.90/1.10	–
P11	K11597	0.05/0.15	0.30/0.60	0.025	0.025	0.50/1.00	1.00/1.50	0.44/0.65	–
P12	K11562	0.05/0.15	0.30/0.61	0.025	0.025	0.50 maxi	0.80/1.25	0.44/0.65	–
P15	K11578	0.05/0.15	0.30/0.60	0.025	0.025	1.15/1.65	–	0.44/0.65	–
P21	K31545	0.05/0.15	0.30/0.60	0.025	0.025	0.50 maxi	2.65/3.35	0.80/1.06	–
P22	K21590	0.05/0.15	0.30/0.60	0.025	0.025	0.50 maxi	1.90/2.60	0.87/1.13	–
P91	K91560	0.08/0.12	0.30/0.60	0.020	0.010	0.20/0.50	8.00/9.50	0.85/1.05	B
P92	K92460	0.07/0.13	0.30/0.60	0.020	0.010	0.50 maxi	8.50/9.50	0.30/0.60	C
P122	K92930	0.07/0.14	0.70 maxi	0.020	0.010	0.50 maxi	10.00/12.50	0.25/0.60	D

A 4 x % C ≤ % Ti ≤ 0.70 % or 8 x % C ≤ % Nb ≤ 10 x % C

B V : 0.18 – 0.25 / N : 0.030 – 0.070 / Ni : 0.40 maxi / Al : 0.04 maxi / Nb : 0.06 – 0.10

C V : 0.15 – 0.25 / N : 0.030 – 0.070 / Ni : 0.40 maxi / Al : 0.04 maxi / Nb : 0.04 – 0.09 / W : 1.50 – 2.00 / B : 0.001 – 0.006

D V : 0.15 – 0.30 / W : 1.50 – 2.50 / Cu : 0.30 – 1.70 / Nb : 0.04 – 0.10 / B : 0.0005 – 0.005 / N : 0.040 – 0.100 / Ni : 0.50 maxi / Al : 0.040 maxi

TENSILE REQUIREMENTS

Grade	Minimum tensile strength		Minimum yield strength		Minimum elongation (1)	
	ksi	MPa	ksi	MPa	Longitudinal	Transverse
P1 & P2	55.0	380	30.0	205	30	20
P12	60.0	415	32.0	220	30	20
P91	85.0	585	60.0	415	20	–
P92	90.0	620	64.0	440	30	20
P122(2)	90.0	620	58.0	400	20	–
All others	60.0	415	30.0	205	30	20

(1) Minimum elongation for walls 8 mm (5/16") and over in thickness, strip tests, and for all small sizes tested, in full section

(2) Maximum hardness : 250 HB

TOLERANCES : (conform to ASTM A 530 / A 530 M-99)

Similar to ASTM A 333 / A 333 M-99

HYDROSTATIC TEST PRESSURE : (see ASTM A 530 / A 530 M-99)

Given by the formula $P = \frac{2 S T}{D}$

DIMENSIONS : see pages 40 and following

ASTM A 671 – 96 / ASTM A 672 – 96 / ASTM A 691 – 98

SCOPE :

This specification covers electric-fusion welded steel pipe with filler metal added, fabricated from pressure vessel quality plate and suitable for high pressure service :

– A 671-96 : at atmospheric and lower temperatures,

– A 672-96 : at moderate temperatures,

– A 691-98 : at high temperatures.

SIZE RANGE :

	A 671–96	A 672–96 and A 691–98
Outside diameter	16 in. (405 mm) or larger	
Wall thickness	1/4 in. (6.4 mm) or greater	up to 3 in. (75 mm) inclusive

MANUFACTURE – CLASSES : (see page 31)

Class designates :

Section 1 the type of heat treatment performed during manufacture of the pipe :
all classes other than 10, 11, 12 and 13 shall be heat treated.

Section 9 whether the weld is radiographically examined :
the full length of each weld of classes X1 and X2 shall be radiographically examined.

Section 8.3 whether the pipe has been pressure tested :
classes X2 and X3 pipe shall be pressure tested in accordance with specification A 530 / A 530 M section 20

GRADES : (see page 33)

Grade designates the type of plate used as listed in ASTM specifications in the table of pages 33 and 35.

CHEMICAL COMPOSITION :

Product analysis of plate :
the pipe manufacturer shall make an analysis of each mill heat of plate material. The product analysis so determined shall meet the requirements of the plate specification to which the material was ordered.

Product analyses of weld :
the pipe manufacturer shall make an analysis of finished deposited weld material from each 200 ft (61 m) for ASTM A 671 and A 691 and from each 500 ft (152 m) for ASTM A 672, or fraction thereof.

TENSILE REQUIREMENTS :

Transverse tensile properties to the welded joint and of the base plate shall meet the mechanical test requirements of the plate specifications.

TOLERANCES

Outside diameter	± 0.5 % of the specified outside diameter based on circumferential measurement
Out-of roundness	difference between major and minor outside diameters : 1 %
Thickness	no more than 0.01 in. (0.25 mm) under the specified nominal thickness

HYDROSTATIC TEST PRESSURE : (see ASTM A 530 / A 530 M-99)

Given by the formula
$$P = \frac{2 S T}{D}$$

DIMENSIONS : see pages 40 and following

ASTM A 671 - 96 / ASTM A 672 - 96 / ASTM A 691 - 98

MANUFACTURE - CLASSES :

Class designations (note 1)				ASTM specification of pipe		
Class	Heat treatment on pipe	Radiography see section :	Pressure test see section :	A 671-96	A 672-96	A 691-98
10	none	none	none	●	●	●
11		9	none	●	●	●
12		9	8.3	●	●	●
13		none	8.3	●	●	●
20	stress relieved	none	none	●	●	●
21		9	none	●	●	●
22		9	8.3	●	●	●
23		none	8.3	●	●	●
30	normalized	none	none	●	●	●
31		9	none	●	●	●
32		9	8.3	●	●	●
33		none	8.3	●	●	●
40	normalized and tempered	none	none	●	●	●
41		9	none	●	●	●
42		9	8.3	●	●	●
43		none	8.3	●	●	●
50	quenched and tempered	none	none	●	●	●
51		9	none	●	●	●
52		9	8.3	●	●	●
53		none	8.3	●	●	●
60	normalized and precipitation heat treated	none	none	●		
61		9	none	●		
62		9	8.3	●		
63		none	8.3	●		
70	quenched and precipitation heat treated	none	none	●		
71		9	none	●		
72		9	8.3	●		
73		none	8.3	●		

Note 1 : Selection of materials should be made with attention to service temperature.
 For such guidance, specification A 20 / A 20 M may be consulted.

ASTM A 671 - 96 / ASTM A 672 - 96 / ASTM A 691 - 98

GRADES :

Plate specification			Pipe specification and grade		
Type of steel	ASTM		ASTM		
	N°	Grade	A 671-96	A 672-96	A 691-98
plain carbon	A 285 / A 285 M	A	–	A 45	–
	A 285 / A 285 M	B	–	A 50	–
	A 285 / A 285 M	C	CA 55	A 55	–
plain carbon	A 442 / A 442 M	55	CE 55	E 55	–
	A 442 / A 442 M	60	CE 60	E 60	–
plain carbon, killed	A 515 / A 515 M	55	–	B 55	–
	A 515 / A 515 M	60	CB 60	B 60	–
	A 515 / A 515 M	65	CB 65	B 65	–
	A 515 / A 515 M	70	CB 70	B 70	–
plain carbon, killed, fine grain	A 516 / A 516 M	55	–	C 55	–
	A 516 / A 516 M	60	CC 60	C 60	–
	A 516 / A 516 M	65	CC 65	C 65	–
	A 516 / A 516 M	70	CC 70	C 70	–
carbon-molybdenum steel	A 204 / A 204 M	A	–	L 65	CM 65
	A 204 / A 204 M	B	–	L 70	CM 70
	A 204 / A 204 M	C	–	L 75	CM 75
manganese-silicon steel	A 299 / A 299 M	–	CK 75	N 75	CMS 75
manganese-silicon steel, normalized	A 537 / A 537 M	1	CD 70	D 70	CMSH 70
manganese-silicon steel, quenched and tempered	A 537 / A 537 M	2	CD 80	D 80	CMSH 80
manganese-molybdenum, normalized	A 302 / A 302 M	A	–	H 75	–
	A 302 / A 302 M	B, C or D	–	H 80	–
manganese-molybdenum, quenched and tempered	A 533 / A 533 M	Cl-1*	–	J 80	–
	A 533 / A 533 M	Cl-2*	–	J 90	–
	A 533 / A 533 M	Cl-3*	–	J 100	–
chromium-manganese-silicon	A 202 / A 202 M	A	–	K 75	–
	A 202 / A 202 M	B	–	K 85	–
nickel steel	A 203 / A 203 M	A	CF 65	–	–
	A 203 / A 203 M	B	CF 70	–	–
	A 203 / A 203 M	D	CF 66	–	–
	A 203 / A 203 M	E	CF 71	–	–

* any grade may be furnished

GRADES :

[illegible]